An Energy Efficiency Workshop & Exposition

Kansas City, Missouri

Software Tools for Implementing Energy Efficiency

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http://energybuilder.com

- **Your Computer: A Sustainable Design Resource**
  - Why Use A Computer Energy Tool?
  - Over 210 different tools out there !
  - Basic Types / How to Choose…
    - **Calculators**
    - **Spreadsheets**
    - **"8760" Sims**
    - **Correlation-based**
    - **Part-year (Seasonal)**
    - **Expert Systems (CD's)**
  - Why Bother with Sustainable Design?
  - Then, let's go over some examples…

Sustainable Design -- Why Bother?

Impacts of Our Built-environment

- greenhouse gas
- resource depletion
- water pollution
- solid waste
- toxic emissions
- societal costs

Reduce "planetary load" from our buildings;
about 40% of our environmental impacts…

Significantly reduce our buildings' energy consumption

Design, specify, build, commission adapt for reuse, and deconstruct in concert with the environment

Well-advised use of both natural and man-made construction products

Better understand life-cycle environmental consequences

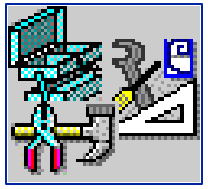
-- resource extraction	-- transportation
-- manufacturing	-- incorporation
-- packaging	-- maintenance
-- marketing, sales	-- reuse, recycling

Sustainable Design Resources -- Some Examples

- **Energy-10 / DLESB**
- **EnergyPLUS V1.0** ***(new!)***
- **DOE-2**, Blast, HotCAN2000, etc.
- **REM/Design - REM/Rate**
- *ORNL Wall Calculators* (web-sites)
- *Wright-X … "ACCA Manual's"*
- *Green Building Advisor* (CD-ROM)
- B.E.E.S. - NIST Enviro Tool

- **When to use, what tool?**
  - Identify the "customer"
  - What do they need to know?
    - . Early-design phase
    - .. Schematic design
    - ... Plan reviews / Revisions
    - .... Codes compliance
  - Size HVAC / passive system
  - Energy performance "rating"
  - Existing building retrofit

Project issues impacts on tool selection:

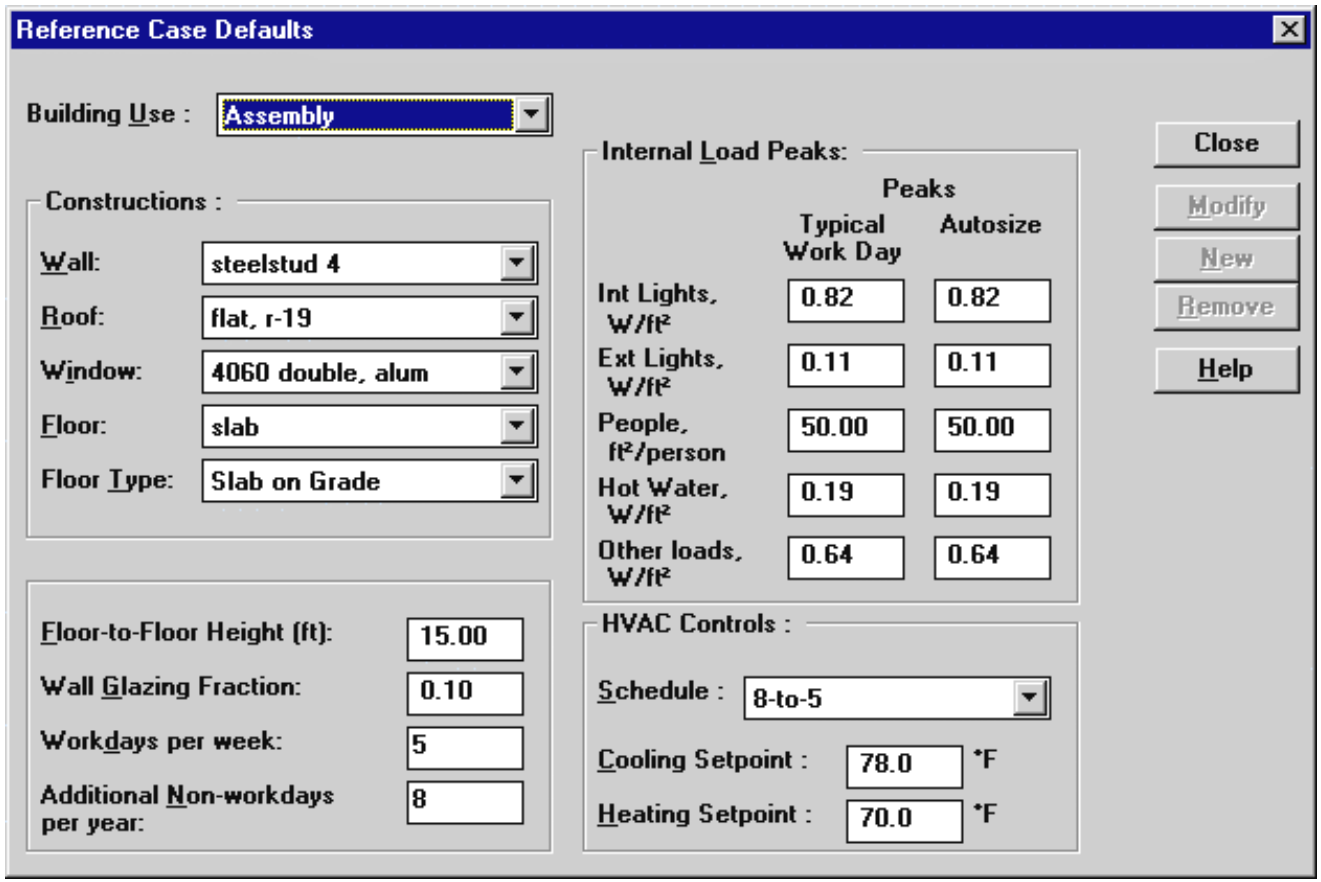


- type of project *(commercial or residential)*
- size of the project
- proposed occupancy / uses
- new design, a remodel, an addition
- total rehabilitation / adaptive reuse
- site characteristics known / not
- weather data available / not
- tool supports climate specific design
- renewable energy source calculations
- detail level in output report(s)

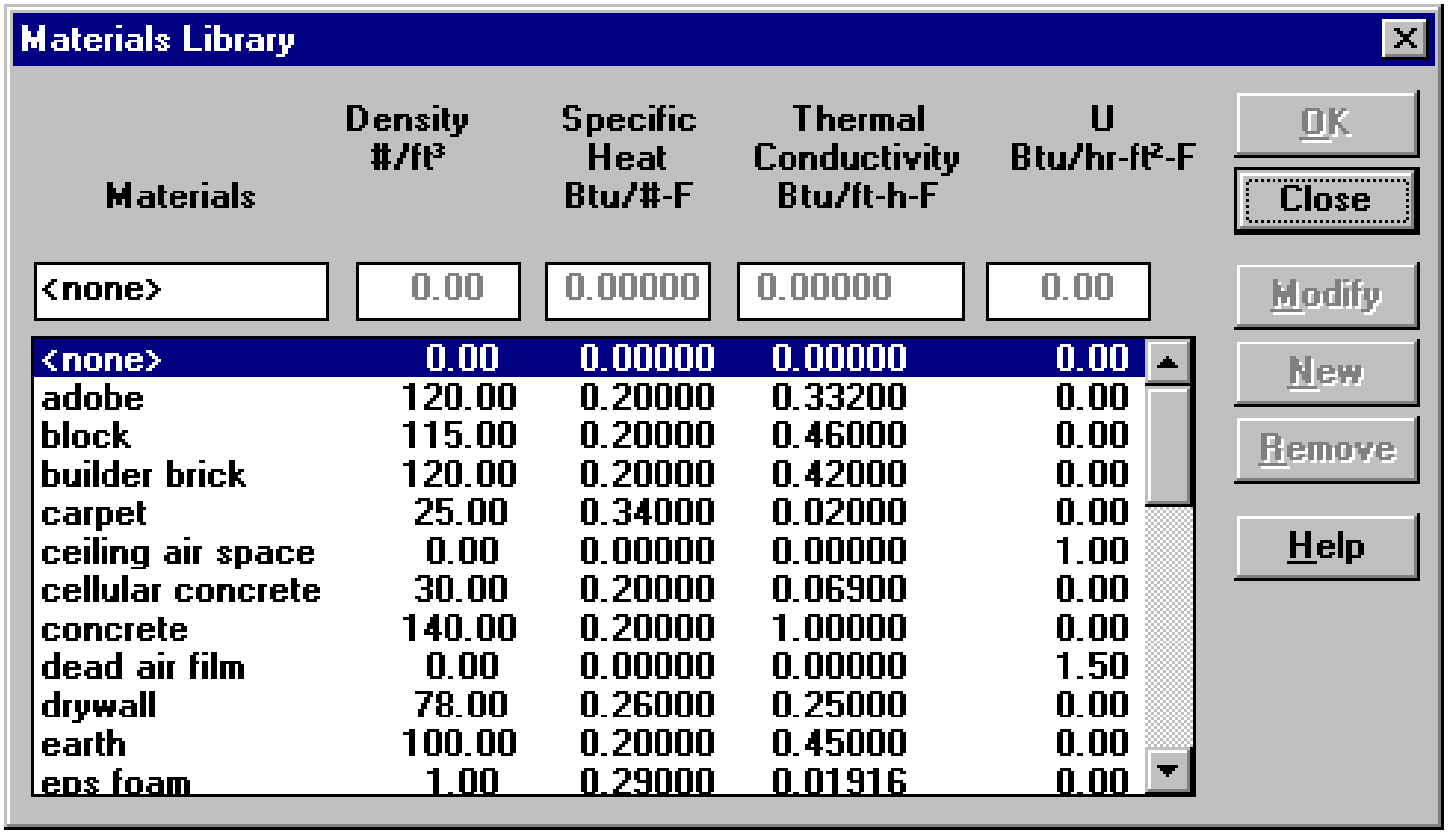
Factors influencing selection and purchase:

- Your level of computing power ?
- How much interactivity do you need ?
- Do you intend to input each spec of every building component ?
- How accurate are (need to be) results ?
- Built-in error control / identification ?
- Easy to install / uninstall ?
- User-friendly, “help” documentation ?
- Is training provided, extra cost, quality ?
- Customer support, demos, updates ?

- **Overview of selected tools:** Energy 10 - Designing Low Energy Sustainable Buildings



- **Overview of selected tools:** Energy 10



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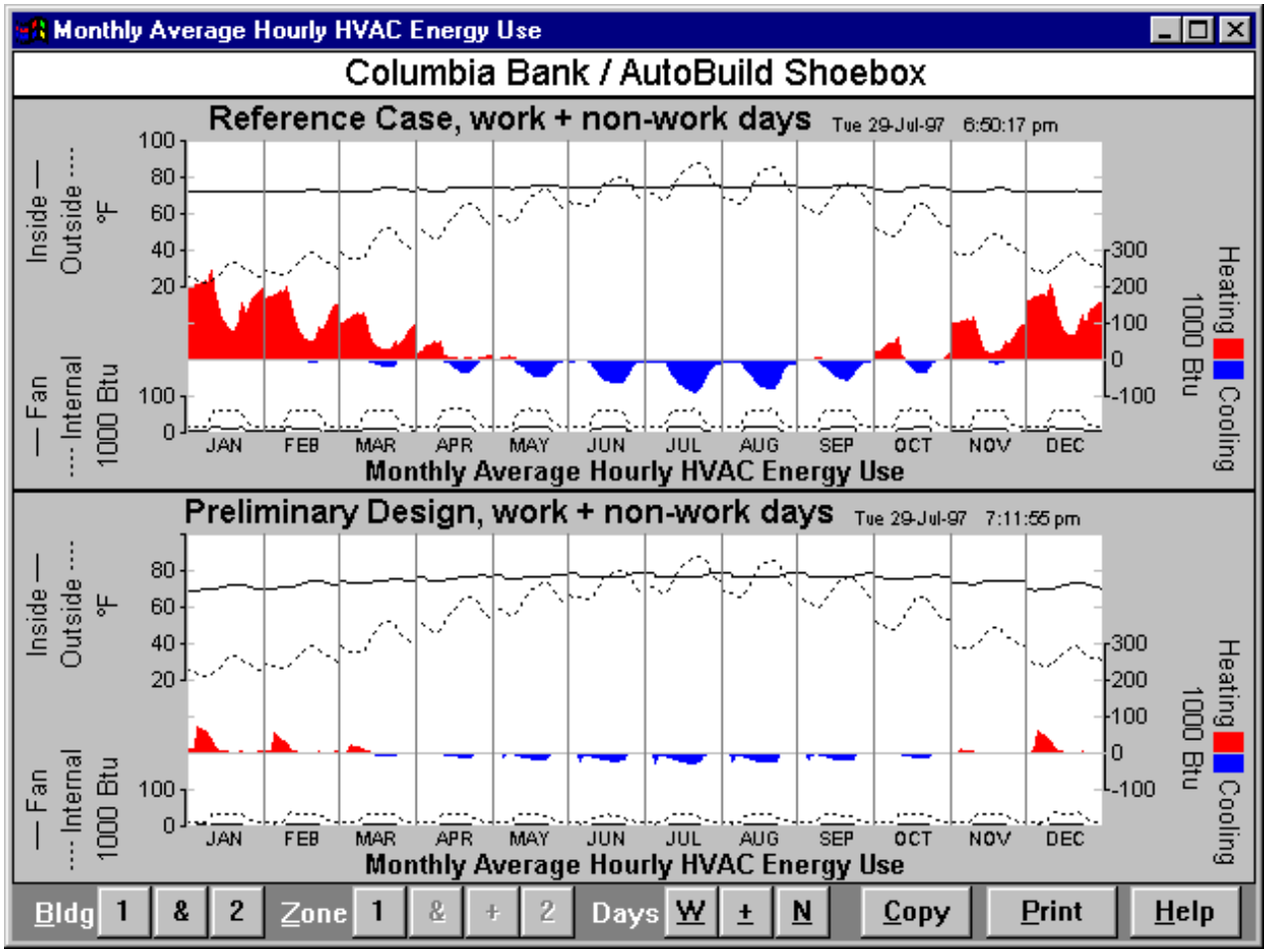

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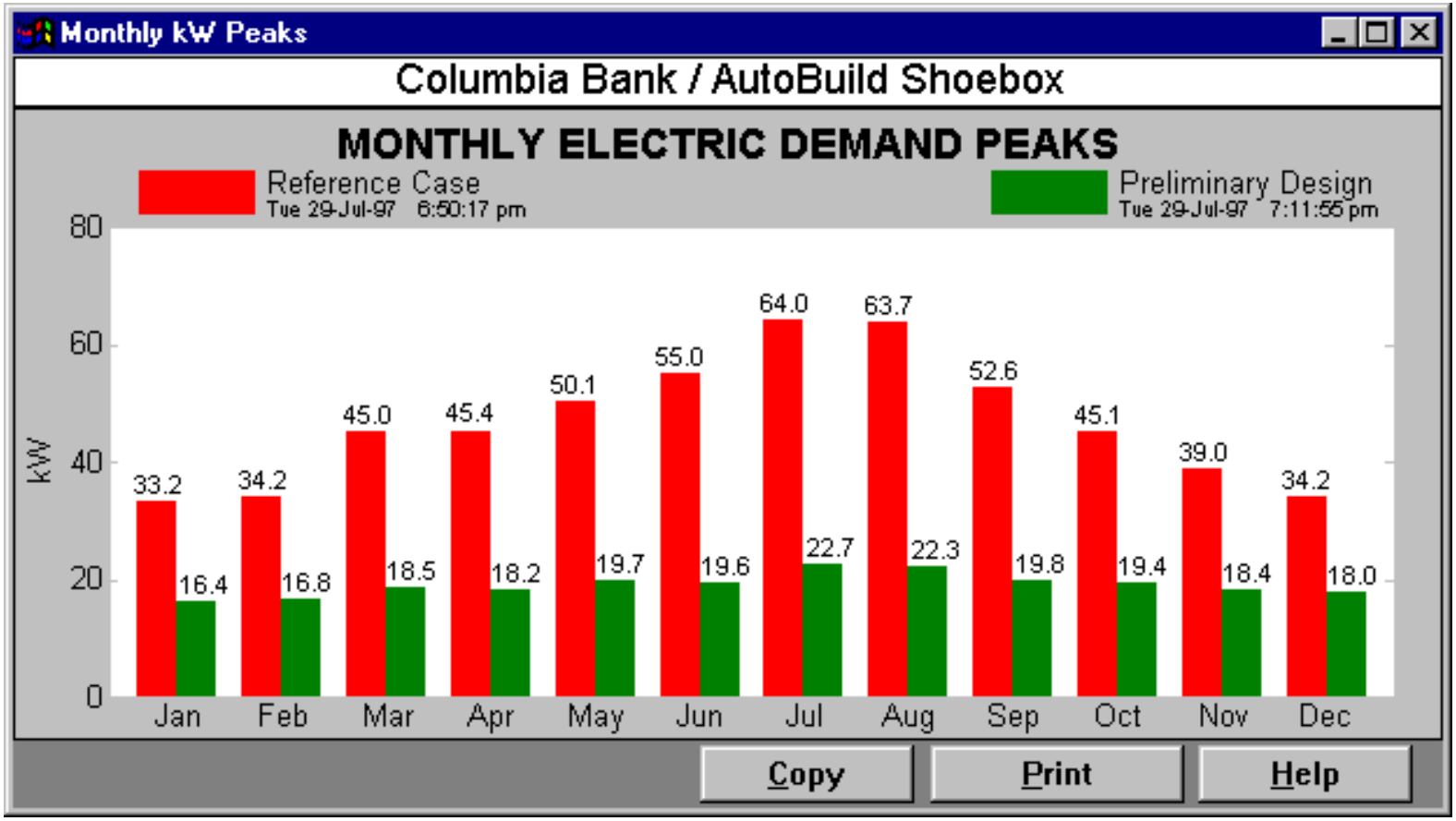
http://www.sbicouncil.org



- **Overview of selected tools:** EnergyPLUS 1.0

New generation energy sim. program

- builds on DOE-2 and BLAST
- adds new and innovative simulation capabilities
- time-steps of less than an hour
- modular systems simulation approach
- heat balance-based zone simulation
- IO data structures facilitate third party interface development (interoperability)

http://www.eren.doe.gov/buildings/energy_tools/energyplus/

- **Overview of selected tools:** EnergyPLUS 1.0

Top-level Features

- Extensive example HVAC input files
- Ability to translate BLAST, and DOE-2 files
- Simultaneous sim. zone loads and HVAC systems
- Reference Data Sets *("libraries" for materials, constructions, etc.)*
- First-level energy meter reporting
- Weather processor:
  read multiple interval-per-hour weather data files

- **Overview of selected tools:** EnergyPLUS 1.0

Building Related Capabilities

- Interior surface convection
- Thermal comfort options
- Air flow sizing *(based on zone requirements)*
- Improved sky model for daylighting calculations
- Example Passive Trombe' wall input template
- Daylighting *(broad array of capabilities)*

- **Overview of selected tools:** EnergyPLUS 1.0

Building Related Capabilities (2)

- Return air heat gain enhancement calculation
- Window modeling, enhanced *(frame and dividers, spectral input for glass)*
- Moisture calculations
- Thermal Comfort modeling and reporting (KSU)
- Shading of sky IR by obstructions
- Controls for natural ventilation through windows

- **Overview of selected tools:** EnergyPLUS 1.0

Systems Related Capabilities

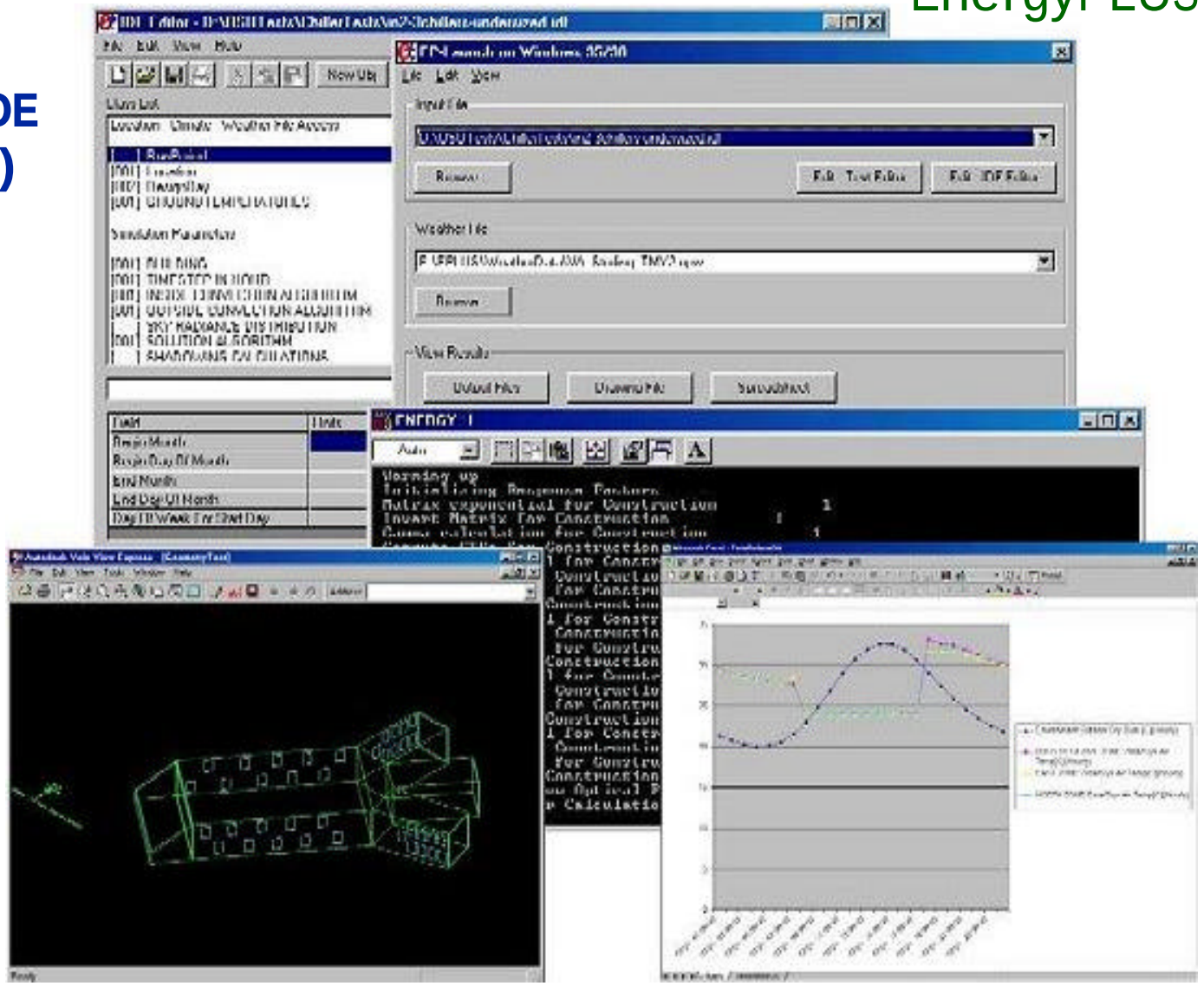
- DX System *(Air Loop)*
- Heat pump simulations
- Gas absorption chiller heater
- Desiccant dehumidifier
- Air-cooled condenser
- Low temp radiant heating/cooling
- High temperature radiant heating/cooling

- **Overview of selected tools:** EnergyPLUS 1.0

Systems Related Capabilities (2)

- Gas/electric unit heaters and ventilators coil options
- Evaporative cooler models
- Flat plate exhaust air heat recovery
- Steam absorption chiller
- Furnace model, with Heat-Cool option
- Variety of other Fan Coil, Unit Heater, Unit-ventilator, Window AC simulation options

Screen shots (DOE website)



Summary

- Simplified tools with Real Power
- Users need considerable experience w/ energy efficiency and computers
- Useful in whole-building assessment
- Training is available *for some*
- Much remains to be done, interoperability
- When in doubt? - *consider energy / environmental professional assistance*